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Cyclodextrin polymers as versatile tools for homogeneous photochemistry in water to produce oxygen releasing agents

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Abstract

There's wide interest in the design of Oxygen releasing agents (ORA) as molecular systems able to supply O_2 in tissues. They are promising for various therapeutic applications, such as the relieve of low oxygen levels in tumor tissues inducing resistance to chemotherapy, the improvement of the efficacy of Photodynamic Therapy (PDT) in conditions of hypoxia, etc. We selected some new derivatives of Anthracenes and Naphthalenes as ORA candidates on basis of computational calculations. Then, biocompatible cyclodextrin (CyD) polymers were explored to implement the photochemical synthesis of ORA with the selected aromatic compounds.1 Visible light photocatalyzed conversion of the aromatic substrates in endoperoxides has been achieved in the presence of methylene blue (MB) in homogeneous aqueous environment thanks to the use of CyD polymers as inert reaction matrix solubilizing the aromatics.2 In a first approach, few ml of CyD polymer solution of the aromatics and MB were irradiated with Hg lamp, next flow photochemistry with red emissive leds was exploited to optimize the reaction time and product amount. Some of the endoperoxides obtained indeed act as ORA and release O_2 thermally either in its triplet state to feed the PS or as singlet oxygen ($^1O_2$). Next, co-encapsulation of the ORA and PS in the CyD polymeric carrier has been achieved in dosage-consistent amounts for the implementation of PDT under hypoxia. Our results forecast the use of CyD polymers as interesting, scalable vessel for the green production of new molecules and the delivery of a combination of therapeutic agents.

References

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